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RAYMOND PATRICK HADOW,
PRESIDENT, 1927-1928.



COL. CUSACK WALTON,
PRESIDENT, 1928-1929.

ADDRESS

OF

COL. CUSAC WALTON,

PRESIDENT.

YOUR EXCELLENCY AND GENTLEMEN,

It is my privilege to express on behalf of the Council and the Members of this Congress the great pleasure we all feel that Your Excellency has honoured us with your presence here to-day, and to welcome many officers of the Punjab Government and other visitors whose presence here indicates their interest in the work of Engineers in this Province.

2. My predecessor last year reminded you of the definition of an Engineer as one who directs the great sources of power in nature for the use and convenience of man. With a Government that is so outstanding in advancing the development of the Province according to modern ideas, it is inevitable that the services of Engineers are very greatly in demand in the various directions of material development. In fact now-a-days the Revenue Officer and Administrator is so closely concerned with the Engineer and his work that there must necessarily be very close association between them.

3. It is a matter of common knowledge that Your Excellency's predecessor was responsible for great development of this Province in recent years and how marked an impetus was given to roads and railways by Sir Malcolm Hailey's personal interest and advocacy.

4. I wish also to take this opportunity of thanking the Members of this Congress for electing me as their President for this year. I appreciate the honour not only as a personal distinction but on behalf of that wide branch of Engineering, *viz.*, Railway Engineering, with which I have been closely connected since 1901.

5. As is usual on this occasion I shall refer briefly to the progress during the past year in the other branches of Engineering in this Province, and I hope you will bear with me if I then take as my main theme a subject in which I am greatly interested and daily occupied not for any egotistical reasons but because it is easier to speak on a subject with which one is familiar than on other subjects, for in his training and service an Engineer generally leaves public speaking to other people.

6. On the Sutlej Valley project progress can be gauged by the fact that about 2½ crores of rupees have been spent and the Panjnad Headworks, now in full swing and due to be ready for the diversion of the river next autumn, is the last work of first magnitude remaining to be built. Apart from this weir all energies have been devoted to the completion of the distributary systems and the excavation of watercourses. Last hot weather 9 of the 11 canals were in flow and managed to do a fair amount of irrigation, partly in newly developed tracts and partly in old inundation areas.

7. Important drainage works have been under construction in the Mona Drain in the Shahpur District and the Aik and Sambrial Drains in the Sialkot District. The latter works were sufficiently advanced to function during the last monsoon with great advantage to the areas they served on the occasion of the record river floods and heavy rainfall at the beginning of September.

8. Measures taken to deal with water-logging include the lowering of the level of the Upper Chenab Canal in various reaches, and particular interest attaches to the two hydrautomat pumping plants constructed at Bambanwala on the Upper Chenab Canal, from the fact that they are the first plants of the type to be constructed in India, and also, it is believed, of their capacity in the world. These plants give an extremely economical method of pumping water.

9. On the Uhl River Hydro-Electric Project the haulageways and tramways are completed and give access to the Uhl Valley over a ridge which rises to 8,000 feet above sea level, the maximum rise being 4,000 feet. The temporary power-house worked by water power on the Shanan side is completed and the other at Brot in the Uhl Valley is approaching completion. Now that both the North and the South Adits have been completed, the driving of the main tunnel is progressing from both ends. The first shot in the main tunnel was fired on the 12th October 1928. Arrangements were made to deliver stores and material by rail as soon as the rails were laid to Jogindarnagar on the 18th November 1928. The distribution system in Lyallpur, pending the supply of hydro-electric current, was energised on February 11th, 1929, from a temporary power-house which will later accommodate the transforming plant.

10. In the way of building schemes of the Public Works Department reference must be made to the large housing scheme for Indian Clerks employed by Government in Lahore on an estate near Chouburji. A fully equipped maternity hospital and a dental hospital are nearing completion in Lahore and a second Central Jail is being built at Multan in accordance with the recommendations of the Jail Commission and a reformatory at Burewala. Those of you who have recently visited the Fort in Lahore will have seen how it is being demilitarised and the side towards the city converted into terraces where the people can take the air in pleasant surroundings. The

Lahore-Sargodha road was opened to traffic in April 1928. The continued growth of motor traffic and has accentuated the problems of road construction and maintenance. During the year 102 miles of metalled road will have been added to the Province from Provincial revenues and 22 miles from capital expenditure. The Buildings and Roads Branch is at present engaged in erecting what will be the longest suspension bridge in the Province over the Haro River at Choi near Campbellpur.

11. By arrangement between the North Western Railway and the Public Works Department the bridges over the Chenab near Chiniot, over the Jhelum near Khushab and over the Ravi near Dera Baba Nanak are being built as combined road and rail bridges, while the bridge over the Ferozepore Weir is an example of even wider co-operation as rail and road bridges have been provided separately resting on extensions of the piers of the canal weir. The new Sutlej Valley Canals have necessitated the provision of numerous bridges where their alignments cross the Railway.

12. I shall now pass on to what I have chosen as my main theme, the development of Railways in the Punjab. As railways enter into a very large proportion of the lives of the people of the Province, I feel sure that you will bear with me while I deal with this subject remembering also the reason I gave before for its selection.

13. The fact that Railways are under different control from other public works in the Province and look to the Central Government for direction of policy and funds of necessity results in less close contact between Railway Engineers on the one hand and Irrigation, Buildings and Roads and Hydro-Electrical Engineers on the other. In addition to this the Engineering profession now covers such an enormous field that it in reality is composed of Engineers of very varying training and experience.

14. The need, however, for close contact between all the Engineering branches of the Province is based on the necessity of avoiding any dissipation of resources and of each branch contributing its quota to large schemes of development.

15. As an illustration we can take the Lyallpur Colony in which communications were only provided when the necessity for them was felt for the impossibility of exporting the surplus produce. Since those days we have learnt much and the provision of road and rail communication now coincides with irrigation—in the case of rail communication either in the form of new railways or in the provision of better booking facilities at existing stations and increased capacity of the section.

16. Some idea of the influence of irrigation on railway requirements may be obtained from a study of recent developments on the

line between Raewind and Khanewal. For many years this area was practically a desert with negligible local traffic and the importance of this section of railway lay solely in its being part of the mainline connection between Lahore and Karachi, but since the Lower Bari Doab Canal came into this area the situation has changed with the result that in 1924-25 goods handled at stations on this section amounted to 216,000 tons in a year, and this coupled with the increase in passenger traffic has necessitated the entire remodelling and enlarging of stations—Kot Radha Kishen, Pattoki, Okara, Montgomery, Mian Channu and Chichawatni.

17. The process in short is that canals bring the population and make available an exportable surplus which give the first traffic to the railway and later on the population as it thrives has less to export but demands more imports. Trade thus thrives generally and traffic is engendered both by road and rail. The present Nili Bar Colonisation Scheme is based on modern ideas and the provision of communications and other amenities is taking place simultaneously with the development from irrigation.

18. In this land-locked Province with its easy access to its nearest port of Karachi, 750 miles from Lahore, and its communications with other parts of India we are apt to forget the advantages that this and other Provinces of India gain by being under one Central Government. For we have only to look to Europe to see how hampered land-locked states are in their access to the sea by customs barriers and relations with foreign governments owning the ports.

19. In our case Karachi came to be under the Bombay Government as in the early days of British occupation in Northern India it was most accessible to that Government, but evidently any difficulties there are in the Punjab's use of Karachi as a port have never been so great as to lead the Punjab Government to demand the transfer of Sind to the Punjab.

20. There is no doubt that for centuries the rivers of the Punjab afforded certain of the main lines of communication in the Province and through the Indus with the sea. When railways displaced navigation as means of communication the tendency was to run parallel with the rivers except in the case of the main lateral communication between Delhi, Lahore and Peshawar where it was run parallel to and sometimes on the Grand Trunk Road.

21. But before the advent of railways there came a change over the use of the rivers by the introduction of steam nagivation. In the year 1835 the Government of India placed the first steamer on the Indus and the fleet gradually increased. This service was called the Indus Steam Flotilla with headquarters and workshops at Kotri. It must be remembered that the port of Karachi is some distance away from the mouth of the Indus, and that steamers proceeding down

the Indus to Karachi would have to face the open sea and therefore to choose seasons other than the monsoon, as river steamers are not built for ocean navigation.

22. It is of historical interest to note that in 1861 the Sind Punjab and Delhi Railway Company opened the line between Karachi and Kotri, a length of 105 miles and thus eliminated the portion of the journey which suffered from the difficulty just mentioned. In the following year they took over from Government the Indus Steam Flotilla and in 1865 opened the railway between Lahore and Multan. There was thus established a direct connection between Lahore and Karachi partly by rail and partly by steamer. The steamers plied between Kotri Bunder and Rajghat near Multan. It was in 1878 that through rail communication was established between Karachi and Lahore by the opening of the Indus Valley Railway between Kotri and Multan, but at Sukkur there still remained a ferry until the Lansdowne bridge was built in 1889.

23. As regards the lateral communications, although Amritsar was connected to Lahore in 1862, it was not till 1870 that Delhi and Lahore were connected *via* Ghaziabad, Saharanpur and Ludhiana. Lahore was connected with Peshawar in 1883.

24. The subsequent general trend of railway construction with certain exceptions was to run parallel with the large rivers for two reasons, one as serving the export trade of agricultural produce to the port of Karachi and the other as the most economical course because the bridging of rivers was minimised.

25. The recent development of feeder railways has been in two directions, firstly, to provide feeders into areas in which better communication was justified and secondly, to provide cross-connections between lines running parallel to rivers and between adjacent canal colonies.

26. On the latter class of railways we have under construction bridges over the Indus at Kalabagh in replacement of the existing ferry, over the Jhelum near Khushab, over the Chenab near Chiniot and over the Ravi near Narowal. Incidentally it may be mentioned that the three former of these bridges are being built under lump sum contracts with a view to encouraging private commercial enterprise.

27. Previous to 1886 the various Railway enterprises between Lahore and Karachi in one direction and between Ghaziabad and Peshawar in the other were under 5 different administrations, but on the 1st of January of that year they were amalgamated under State management as the NORTH WESTERN RAILWAY with headquarters in Lahore, the route mileage at that time being about 1,800 miles. At present the route mileage is about 6,800 and the system comprises Commercial and Military sections, the latter of which on the frontier consists of some 1,800 miles.

28. When dealing with recent developments it is not out of place to refer to the re-organization of the administration of the North Western Railway which took effect from October 1924. On that date a system was adopted which is applicable, and I would even say essential, to the smooth working of such a large system, that is to say, the railway was divided into 7 operating Divisions each under a Divisional Superintendent with extensive powers responsible to the Agent at headquarters in Lahore. The Mechanical Workshops are also constituted into a Division. This system, which differs from the American and other Divisional systems, gives the benefits of decentralisation by delegating powers to a responsible official over an area which he can personally supervise while retaining those of centralisation in the matter of co-ordination and technical control.

29. The opportunity was taken of this re-organisation to amalgamate the head offices of all Departments in Lahore with that of the Agent and also to establish a separate Personnel Branch.

30. Time does not permit me to go into the details of this organisation nor into other improvements in recent years such as the introduction of modern methods into Railway Workshops, the establishment of traffic control, the use of the vacuum brake on all goods trains, the extension of signalling and interlocking, improvements of stations and yards, etc., but I must mention the very large programme of renewals of main lines with heavier rails on account of heavier axle loads and faster speeds because this is one of the factors which has made it possible to launch out into a large programme of constructions. Second-hand rails freed from the main lines have in this way been available for new constructions at their depreciated value and have saved something like Rs. 10,000 a mile on the cost of construction. New constructions have also benefited by the use of second-hand girders freed from the main line.

31. The other main factors connected with the starting of the ambitious construction programme are :—

(1) The statement of the Government of India that they are prepared to finance all schemes justified on their own merits or guaranteed by Local Governments, and

(2) the definite acceptance by the Railway Board that new branch and feeder railways should be laid to a lower standard sufficient for traffic immediately offering with a view to subsequent improvement as traffic increases.

32. How far the provision of capital to the extent visualised will materialise in future is perhaps subject to doubt, but since the programme started the North Western Railway has spent on new constructions 517 lakhs of rupees in the Punjab alone and 422 miles have been opened to traffic. The 4 bridges already mentioned in the cross connections should all be ready in about $1\frac{1}{2}$ years time.

33. The projects sanctioned for construction are of course selected from those examined both in regard to engineering costs and traffic prospects. This investigation has been so thorough that some 3,000 miles have been surveyed in the North Western Railway area.

34. The engineering interest of the North Western Railway lies chiefly in its bridges over the large rivers of the Province and in its hill sections. Apart from the Kalka Simla and the Kangra Valley the latter lie outside the Punjab on the frontier from the Khyber to the Bolan where gradients are severe.

35. There can be little doubt that the training works of the large railway bridges have tended to study the courses of the rivers. Besides the bridges under construction which have already been named there exist 16 bridges over the 5 rivers of the Punjab and 4 over the Indus.

36. An examination of the map will show that there are few parts of the Province now not within 15 miles of a railway except in the mountainous area to the North and the waterless tracts.

37. In conclusion I now invite Your Excellency to declare this Congress open.

SPEECH

BY

HIS EXCELLENCY

SIR GEOFFREY deMONTMORENCY,

GOVERNOR OF THE PUNJAB.

I AM very grateful to Colonel Walton for the kind welcome he has extended to me on behalf of the Council and members of the Punjab Engineering Congress.

It is a great interest to me to be present at the opening of the Congress for various reasons. First and foremost among those reasons are personal reasons. It has been a feature of my service in the Punjab that a great deal of my service has been spent in close association with Engineers. I think I served altogether for 8 or 9 years in the Lower Chenab Canal and the Lower Jhelum Canal areas: and during those years I was in almost daily touch with the development by the skill of Irrigation Engineers of those great State properties and assisted them as far as I was able in the side of the projects which related to revenue aspects. In the Lower Chenab Canal area, this period also coincided with a period of considerable railway activity and expansion: and the foundation and development of the export markets of Gojra and Toba Tek Singh and the subsequent construction of the Chichoke Mallian-Shorkot Road branch, with the establishment of *ndis* at Jaranwala and Tandlianwala, brought me into frequent ·ch with Railway officers both in the Engineering and Traffic de- :ments. When I left these Canal Colonies, I went to the Financial mmissioner's office, where the most important question, with /hich I had to deal at the moment; consisted of discussions with the Chief Engineer of the Irrigation Branch regarding the revenue aspects of the Triple Canal Project. A few years later I found myself at Delhi, first of all as Secretary of the Town Planning Committee consisting of a Corporation Engineer, an ex-Chairman of the London County Council and an architect, which advised on the question of the exact site on which the new Capital was to be built and later as Secretary of the Imperial Delhi Committee which prepared and began to execute the original project for the new Capital involving, as it did, a great variety of different kinds of engineering work—roads and buildings, irrigation, drainage, water-supply, electric supply, re-organisation of railway facilities and the like. When after some years' absence I returned to the Punjab it was as Finance Member, where assisted by a Financial Adviser, much of my day was spent in dealing with the financial aspects of the multifarious engineering activities which loom so large in the Punjab budget. At

the end of these experiences I think I can claim to have met from time to time a great many Engineers concerned with different sides of engineering and over a number of years to have acquired no small familiarity with the class of problems that fall to their lot to tackle and with the difficulties that are incidental to their solution; and I can, therefore, speak with an appreciation based on some degree of real personal knowledge of their achievements and of the value of their work to the public weal. When the day comes for me to sever direct touch with their projects and work in India, as far as I am concerned a page of real and absorbing interest in life will have closed for me.

I need not enlarge on the great part engineering is playing in every direction in connection with the development of the Punjab, because Colonel Walton has already dwelt on this topic and on more than one occasion Sir Malcolm Hailey in addressing you has particularly concerned himself with this side of the case. The last few years in the Punjab have been a notable period of moral and material advance in the Province. The contributions to the latter by the development of canal irrigation, railways, roads and the like is perhaps too obvious to need comment, while in regard to the former you will have observed that the Engineer is called in, as for example in connection with education, when concrete manifestation of moral advance has reached a degree of progress which calls for a perpetuation in bricks and mortar.

Nor need I busy myself with the mere increase in the volume or bulk of engineering work. No doubt the examination of budgets of modern times on the engineering side of the North Western Railway Department, the Buildings and Roads Department and the Irrigation Department, side by side with those of some years ago, would point to interesting conclusions in the comparison; but this hardly needs elaboration.

Looking back over engineering in the Punjab for the last thirty years one point stands out which at once impresses the imagination—that is the multifarious nature of the new kinds of demands, created by the growing needs of civilisation and rising standards, which engineering organisation is continually called upon to meet on every side. These bring in their train new problems both of technique and of administration. They create new points of contact and relation with the revenue and the administrative authorities: and new branches have often to be grafted on to the trunk of existing engineering organisations to deal with these new fields of engineering activity.

As far as railways are concerned, Colonel Walton has alluded to a very large number of directions in which in answer to the claims of higher standards of public safety or convenience, very extensive improvements have been carried out in recent times. From the point of view to which I have referred, perhaps the most significant of these

is the conversion of main lines to carry heavier axle loads and faster train services. This is in direct response to modern ideas on the subject which are wont to create from a desire for higher standards an actual claim for a need to be met.

In the Buildings and Roads Deparment of the Public Works modern needs and new public standards have also wrought change. I can remember the time when among all the Governments and administrations in India there was only one architect—the Consulting Architect to the Government of India. The Buildings and Roads Branch in the Punjab, however, have now for a number of years past developed an architectural side. For some time past there has been growing recognition that though the shears of limitation in finance may clip the wings of the architect in such a way that the higher flights of architecture may be out of the question, yet in the Punjab we do require in our buildings what an architect, who specialises in such matters, can also give, namely, more dignity, more harmony, and a closer study of convenience in design and greater attention to detail in execution. Quite apart from public buildings of the larger kind even our humblest residential buildings are all the richer for this expert touch.

On the Electrical side the expansion in new directions has been enormous. Thirty years ago there was scarcely what could be called an electrical side to the Buildings and Roads Branch; to-day the department is in the midst of a great hydro-electric scheme in the Himalaya with all its attendant problems of hydraulics, tunnel driving and generation and transmission at high altitudes in a difficult country. As regards road communications, as in the case of railways, not only has the demand for new communications enormously increased, ut the ever expanding volume of fast motor lorry traffic has brought w problems of its own as regards construction and maintenance. : problem of the conformation and maintenance of dirt roads in districts has also been taken up in answer to a general demand r their improvement. On the side of Sanitary Engineering the period has been marked by the complete disappearance of the public apathy once existing to the conveniences it creates. Though the majority of towns have not quite yet reached the stage where they are prepared to tax themselves adequately for really efficient modern systems of drainage, nevertheless the desire for pure drinking water supplies of different kinds has become universal and the desire for real improvement in drainage amenities is daily increasing and some hundreds of installations to fit various local conditions and financial limitations have been executed. Nor are these longings entirely confined to urban areas.

New also is the Engineering branch of the Agricultural Department which yearly grows busier and busier partly with demands for well-boring and different forms of improvements in mechanism to

lift water from the subsoil for well irrigation and partly with side activities in the design and construction of improved agricultural implements.

Another department of Government is starting the experiment of providing an Engineer, who will be concerned solely with town planning urban improvement, which has now become a specialised science. It remains to be seen whether this nascent activity will be able to show laurels in the Punjab such as those won by the Calcutta Improvements Trust by the construction of the Central Avenue —that bold and magnificent artery which has revolutionised communications in the city by passing right through the heart of the most congested portion of Calcutta and which has already paid for itself in betterment values; but at least the Town Planning Engineer will have a wonderful field for work in those suburbs which are growing up in a haphazard and insanitary manner for want of skilled control in the vicinity of most of our large Punjab towns.

The Irrigation Department in the Punjab can claim to have attacked problems second to none in magnitude and importance in this branch of engineering. For years its Engineers have been fertile in their contribution to the technical work of harnessing the great river by weirs, of constructing headworks and main canals and of devising improvements for regulating the supplies of distributaries and outlets; and though their inventive genious in this respect stands unrivalled, no doubt there is still room for even greater discoveries in this field; and our irrigation engineers will not tire in their quest. But apart from this, new problems of a different kind have begun of late to crowd upon them. For some years past they have been busy with the question of the storage of the excess monsoon river supplies in the valleys of the mountains through which the rive debouch into the plains—supplies that now pass unutilised to These questions involve a new set of geological and construct difficulties in some ways alien in features to those experienced in previous range of their construction work. Of very vital importan also are the measures, upon which the brains of the department are concentrated for preventing or curing the undue rise in the subsoil water-table taking place in areas through which some of the main canals pass. This threatening feature has assumed an increasing importance and has necessitated the formation of a special branch of the Department consisting of a Superintending Engineer, a Chemist and a Statistical Officer, who devote their whole energies to this problem alone. Quite apart from ways and means of securing a safe equilibrium in the subsoil water-table by dewatering the affected areas and of preventing additional accretions to seepage from surface flood water by drainage operations, the situation also necessitates close attention to measures to cope with the deterioration in fertility caused by the salts, which a rising water-table often brings to the surface; and a set of problems arises lying more perhaps in the sphere

of a soil physicist and chemist than that of an engineer, but of vital moment to the latter also.

Equally grave problems await solution in the fall in the water-table which is occurring in parts of the Hoshiarpur and Jullundur Doab and in the denudation of low hills and the consequent diluvion and deterioration by spread of sand on fertile land which the destructive torrents flowing from them cause in submontane tracts. In these spheres also it may be necessary to call in the help of Engineers.

All round, the class of work is changing. To take two small examples, some years ago the building of a large jail consisted merely in erecting simple enclosures, barracks, manufactory-sheds for manual trades and staff residences. The new Central Jail now under construction, however, involves elaborate design and fitting for the use of power in manufacturing processes. In the same way educational buildings once simple in character and involving only concatenations of class rooms, now in the majority of cases, with the expansion of Chemistry and Physics in curricula, call for carefully designed and fitted laboratories in the planning of which the chemist and the engineer must collaborate.

The calls of changing needs also finds expression in a new up-to-date hospital for Indian maternity cases and a school of dentistry recently erected in Lahore.

I could multiply other instances; but what I have said will perhaps suffice to give point to the view that one of the outstanding features of the history of engineering in the last 30 years in the Punjab is the multitude of new classes of demands which expanding civilization and rising standards expect engineering organization to meet. On the technical side the discussion at the meetings of the Engineering Congress must always have had a deep interest and value for the profession and have reacted in great benefit also to those public needs which engineering caters; but the growing pressure to meet new needs and new standards, the new avenues now opened and the new problems that arise from them now seem to me to give both an added zest and an added importance to the papers and exchange of ideas which are features of the Congress. With a deep consciousness of the advantage which the Province may expect to derive from these deliberations, I now declare this Congress open.

ERRATUM SLIP TO MR. BURKITT'S PAPER.

Page 2, *Sub-Para* 3.

After "Critical Velocity" *delete* "ratio."